

## Research Article



# Epidemiological and Hematological Investigations of Tick-Borne Diseases in Small Ruminants in South Waziristan Tribal District, Pakistan

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**Abstract** | Parasitism is regarded as significant risk factor for the dynamic ability of small-ruminants and it sources enormous economic fatalities in most divisions of the globe as well as Pakistan. This study was designed with the objective to determine the hematological profile and prevalence of haemo-parasitic diseases in small ruminants and to correlate it with its health status. Total of 500 blood samples (Sheep, n=250, Goat, n=250) were collected from different areas of South Waziristan. Samples were processed meant for the incidence of haemo-parasites and diverse hematological limitations were anticipated. Prevalence of haemo-parasitic diseases was recorded as 14.4, 10.4 and 7.2% for anaplasmosis, theileriosis and babesiosis, respectively. Different risk factors were studied but statistical significant changes ( $p < 0.05$ ) were observed in prevalence of haemo-parasitic diseases with respect to season, breed, specie, age and sex. Hematological profile of diseased animals showed significant decrease ( $p < 0.05$ ) in TEC, Hb, PCV, MCH and MCV while no significant changes ( $p > 0.05$ ) were observed in MCHC and TLC. On basis of erythrocytic indices in sheep anemia can be classified as macrocytic normochromic while in goats anemia was recorded as macrocytic hypochromic. It can be concluded from the results that anaplasmosis was the most prevalent haemo-parasitic disease followed by Theileriosis and Babesiosis in the study area and along with general health status of the animal it also affect the hematological profile of animals.

**Keywords** | South Waziristan, Haemo-parasitic diseases, Prevalence, Hematology, Risk factors, Anemia,

**Editor** | Muhammad Imran Rashid, Department of Parasitology, University of Veterinary and Animal Sciences, Lahore, Pakistan.

**Received** | May 07, 2021; **Accepted** | August 22, 2021; **Published** | December 30, 2021

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**Citation** | Amin S, Khan J, Khan I, Muhammad D, Khan KU, Khan NU, Jameel MA (2021). Epidemiological and hematological investigations of tick-borne diseases in small ruminants in South Waziristan Tribal District, Pakistan. J. Adv. Parasitol. 8(4): 37-41.

**DOI** | <http://dx.doi.org/10.17582/journal.jap/2021/8.4.37.41>

**ISSN** | 2311-4096



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## INTRODUCTION

Pakistan is an agricultural country having a huge population of livestock which are well adapted to the environmental condition of the country. Our livestock mainly consist of buffalo, cattle, goats and sheep with the population of 33.7 million, 38.3 million, 64.9 million and 28.8mil-

lion, respectively. Sheep plays a major role and occupies a premier place in the livestock industry, contributing significantly to the economy of the Pakistan (PES, 2013-14). Parasitism is considered as important risk factor for the production of small ruminants and it causes huge economic losses in most of the developing and underdeveloped parts of the world (Skyles, 1994). Small ruminants are highly ex-

posed to variety of parasitic infections including intestinal parasitism and haemo-parasitic infections (Anaplasmosis, Theileriosis and Babesiosis) (Maske et al., 1990). Onset of parasitic diseases is mostly high in tropical and subtropical regions of the world (Muraleedharan, 2005).

Anaplasmosis in small ruminants is caused by *Anaplasma marginale* and *Anaplasma phagocytophilum*. Most common clinical signs of anaplasmosis include fever, anemia, jaundice, anorexia, respiratory signs, drop in milk production and reproductive disorders in small ruminants (Stuen et al., 2002, 2003; Garcia-Perez et al., 2003; Razmi et al., 2006). There are huge economic losses due to this disease because of reduced weight gain and productivity losses (Matsumoto et al., 2006).

Theileriosis is a tick-borne disease of domestic animals present in tropical and subtropical regions of the world, transmitted mostly by *Hyalomma*. Clinical signs of theileriosis include lacrimation, anorexia, swelling of superficial lymph nodes, enlargement of spleen, liver and icterus (Naz et al., 2012).

Babesiosis caused by *Babesia ovis*, is a tick transmitted intra-erythrocytic protozoan parasite. Clinical signs of babesiosis include febrile condition, anemia and haemoglobinuria. *Babesia ovis* is transmitted by *Rhiphicephalus* species of ticks in small ruminants.

Pakistan being located in the subtropical zone offer favorable environment for the proliferation of ticks population which are important indicator of haemo-parasitic diseases. Different ticks species like *Hyalomma*, *Rhiphicephalus*, *Ixodidae* and *Boophilus* play an important role in transmission of haemo-parasitic diseases (Eshetu, 2015), while *Hyalomma* species being the most abundant in Pakistan (Atif et al., 2012).

Most of the studies in the past have been carried out on the prevalence of haemo-parasitic diseases in cattle in Pakistan but there is limited data available on the epidemiology of tick borne diseases in small ruminants. Hematological and serum biochemistry profile can be used as an important indicator for prognosis of Tick borne diseases. Due to scarcity of data about haemo-parasitic infection in small ruminants in Pakistan, the present study was designed with the objective to determine the epidemiological and hematological investigations of tick-borne diseases in small ruminants.

## MATERIAL AND METHODS

### STUDY AREA

This study was conducted in South Waziristan Tribal dis-

trict. South Waziristan district lies at 32° N Latitude and 69° E Longitude with an altitude of 1,500– 2,500 meters and has area of 6619 km<sup>2</sup>. Average temperature range from 22.77°C (73°F) to over 35°C (95 °F) in summer and 0.5°C (33 °F) to 11.66°C (53 °F) in winter.

### SAMPLE COLLECTION

During the year 2020 total of 500 blood samples (Sheep=250, Goat=250, Adult=400, young=100, Male=150, Female=350) were collected from different areas of South Waziristan. Blood samples collected were screened for haemo-parasites (*Anaplasma*, *Theileria* and *Babesia*) and for estimation of hematological profile; hematology was performed. Prevalence of Haemo-parasites was estimated using formula.

Where: P: Prevalence; d: No. of animals found positive; n: Total no. of animals sampled (Thrusfield, 1995).

### MICROSCOPIC EXAMINATION

Thin blood smears were prepared and fixed in methanol for 5 min and stained for 30 min in Giemsa stain as described by Jalali et al. (2013). Slides were then examined for haemo-protozoan like *Anaplasma*, *Theileria* and *Babesia* spp. at 100× objective magnification.

### HEMATOLOGY

For finding of hematological profile, 3ml of blood was collected in sterile vacutainer tubes and processed for hematological studies including, Total Erythrocyte Count (TEC), Total Leukocyte Counts (TLC), Hemoglobin levels (Hb) and Packed Cell Volume (PCV) by using Hematology Analyzer (Sysmax KX-21N, Japan). Erythrocytic Indices were also estimated including Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Hemoglobin Concentration (MCHC) (Yasini et al., 2012).

### STATISTICAL ANALYSIS

Data collected was arranged in Ms Office Excel and statistically analyzed by Chi square ( $\chi^2$ ) for prevalence while hematological data was analyzed through t-test: paired two sample means and means were compared by Duncan's multiple range tests at a probability level  $\leq 0.05$  using Statistical Package for Social Services (SPSS) version 23.0.

## RESULTS AND DISCUSSION

### PREVALENCE OF HAEMO-PARASITES IN SMALL RUMINANTS

Out of total 500 blood samples 160 (32%) samples were positive for Haemo-protozoan's in which *Anaplasma*, *Babesia* and *Theileria* was recorded as 14.4, 10.4 and 7.2%, respectively (Table 1).

**Table 1:** Overall prevalence of Haemo-parasites in different small ruminants in South Waziristan Tribal District.

Parasitism	Parasites	N	Prevalence (%)
Haemo-parasites	Anaplasma	500	14.4
	Theileria		10.4
	Babesia		7.2

**Table 2:** Prevalence of Haemo-protozoan in small ruminants in South Waziristan Tribal District with respect to Season, Breed, Specie, Age and Sex

Variables	Category	N	Prevalence of Haemo-protozoan (%)	P value
Season	Winter	100	18	.000
	Spring	150	33	
	Summer	150	70	
	Autumn	100	39	
Breed	Indigenous	250	50	.000
	Cross breed	250	110	
Specie	Sheep	250	113	.000
	Goat	250	47	
Age	Adult	400	139	.008
	Young	100	21	
Sex	Female	350	126	.003
	Male	150	34	

**Table 3:** Hematological profile of sheep and goats suffering from tick borne diseases in South Waziristan Tribal District (Mean  $\pm$  standard error).

Parameter	Sheep		P-Value	Goats		P-Value
	Non Infected	Infected		Non Infected	Infected	
TEC	11.30a $\pm$ 0.083	5.58b $\pm$ 0.09	0.00	11.54a $\pm$ 0.17	5.36b $\pm$ 0.17	0.00
Hb	10.69a $\pm$ 0.18	6.74b $\pm$ 0.07	0.00	11.24a $\pm$ 0.14	5.74b $\pm$ 0.19	0.00
PCV	34.26a $\pm$ 0.32	20.68b $\pm$ 0.36	0.00	35.08a $\pm$ 0.55	20.53b $\pm$ 0.66	0.00
MCH	9.60b $\pm$ 0.15	12.44a $\pm$ 0.16	0.00	9.78b $\pm$ 0.29	10.8a $\pm$ 0.35	0.01
MCV	30.52b $\pm$ 0.6	38.24a $\pm$ 0.59	0.00	31.24b $\pm$ 0.8	39.63a $\pm$ 1.13	0.00
MCHC	32.28a $\pm$ 0.38	32.65a $\pm$ 0.47	0.53	31.67a $\pm$ 0.85	28.37b $\pm$ 1.09	0.02
TLC	9.16a $\pm$ 0.09	9.17a $\pm$ 0.2	0.89	9.05a $\pm$ 0.19	9.35a $\pm$ 0.24	0.29

a, b: means through diverse superscript via in rows are significant at P-value 0.05; Total erythrocytes-count (TEC); Hemoglobin (Hb); Packed cell volume (PCV); Mean corpuscular volume (MCV); Mean corpuscular-hemoglobin(MCH); Mean corpuscular hemoglobin-concentration (MCHC); Total leukocyte count (TLC).

## RISK FACTORS FOR HAEMO-PARASITIC DISEASES

Season wise prevalence of haemo-parasites was 18, 22, 46.66 and 39% in winter, spring, summer and autumn, respectively. Prevalence was recorded as 20% in indigenous while 44% in cross breed. Regarding species, prevalence was 45.2% in sheep and 18.8% in goats whereas, 34.75 and 21% prevalence was recorded in adult and young animals, respectively. Sex wise prevalence was 36% for female and 22.66% for male animals. It is evident from Table 2 that despite of slight differences in variables have significant differences was recorded with respect to season, breed, specie, age and sex.

## HEMATOLOGICAL FINDINGS

Hematological outline (Table 3) of diseased and healthy animals demonstrates significant decline in MCH, Hb, TEC, MCV and PCV while insignificant changes were observed in TLC and MCHC. In sheep anemia can be classified as on basis of erythrocytic indices and macrocytic normochromic whereas in goats anemia is macrocytic-hypochromic.

Pakistan is an agricultural state has massive populace of domestic animals, in which sheep and goats population are 28.80 million and 64.92 million, correspondingly (PES, 2013-2014). In spite of this vast population productive

capability of these animals are not according to the necessitate. Haemo-parasitic infections (Anaplasmosis, Theileriosis and Babesiosis) are significant parasitic sickness of small ruminants in the world but outcomes are further awful in sub-tropical and tropical areas of world, comprising Pakistan (Silke, 2009; Sathaporn et al., 2004).

In present study anaplasmosis was most prevalent disease among the haemo-parasitic diseases of small ruminant and these conclusions are in conformity with the consequences of Takeet et al. (2009), Puvarajan et al. (2014) that the most prevalent haemo-protozoan disease is anaplasmosis in small ruminants. In the present study prevalence of Anaplasmosis, Theileriosis and Babesiosis was 14.4, 10.4 and 7.2%, respectively. Anaplasmosis was recorded higher i.e. 40.0% which is not in agreement with the results of Khan et al. (2015) where incidence of Anaplasma was 28.0%. Possible cause for this unconcern might be due to the information that Khan et al. (2015) carried out their study only in sheep and study area was district Peshawar, while the current study sampling area was in South Waziristan. Other possible causes for this difference might be dissimilarity in sampling size and addition of goats in the present study. Prevalence of Theileriosis was approximately similar with the results of Naz et al. (2012). Babesia incidence recorded in present study was subordinate from the study mannered by Esmailnejad et al. (2012). This might exist the geographical divergence and also Polymerase Chain Reaction was used as a investigative tool by Esmailnejad et al. (2012) which are more responsive and exact diagnostic test as contrast to microscopy which is used in current-study.

Prevalence of parasitic diseases was found to be significant with respect to season, breed, specie, age and sex. These results were contrast with study conceded out by Naz et al. (2012) that season, breed, specie, age and sex had effect on prevalence of parasitic diseases in goats and sheep. In current study prevalence in both sheep and goats was significant with respect to season, breed, specie, age and sex. Haemo-parasitism though significant, was recorded higher in summer, autumn and spring as compare to winter. This statement is supported by the findings of Velusamy (2015) that prevalence was recorded higher in hot months of the year. Higher prevalence of haemo-protozoan in hot and humid months of the year can be due to the availability of favorable environment for the infestation of arthropod vectors in these months which play pivot role in the transmission of these diseases (Atif et al., 2012; Durrani, 2008; Sajid, 2007).

Hematological findings showed significant decrease in value of TEC, Hb, PCV, MCH and MCV while in MCHC and TLC no significant changes were observed in sheep. Hematological parameters were almost similar

in both sheep and goats except MCHC which was found statistically significant decrease in goats. Study carried out by Esmailnejad et al. (2012) endorsed the statement that MCHC was statistically significant in goats affected with haemo-parasites. Results of hematology were almost similar to the findings of Khan et al. (2015), Younis et al. (2010), Ahmadi hamedani et al. (2012). On the basis of erythrocytic indices anemia can be classified as macrocytic nor-mochromic in sheep with increase in MCV and MCHC in normal range. In goats significant increase was observed in MCV while statistical significant decrease was noticed in MCHC values and anemia can be classified as macrocytic hypochromic.

## CONCLUSION

Based on these findings, it can be concluded that anaplasmosis the most prevalent haemo-parasitic disease in small ruminants, followed by Theileriosis and Babesiosis in the studied area. Beside with common fitness statuses, hematological outline of infected animals can else be precious and consequently should exist measured as indications of parasitism.

## ACKNOWLEDGEMENTS

Authors are thankful to the University authorities and Specially to Dr. Jabbar Khan for his kind support to conduct this research.

## CONFLICT OF INTEREST

There is no conflict of interest.

## NOVELTY STATEMENT

The study was performed to determine the Hematological Investigations of Tick-Borne Diseases in Small Ruminants. The explored information of this study will give an overall idea about the distribution of Blood parasitic infections among the study areas. It will also provide some epidemiological ideas in the occurrence of such diseases. However, this study will make the way to take further extensive study related to these infections which will help to take necessary preventive and control measures against them

## AUTHORS CONTRIBUTION

JK and SA imagine idea of the manuscript. IK and DM collected and processed blood samples. SA analyzed the data and drafts the manuscript. All authors reviewed the final version of the manuscript.



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